IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Applicant	:	Haruyo Fukui, et al.
App. No.	:	10/065,992
Filed	:	December 8, 2002
Title of Invention		Surface-Coated Machining Tools
Examiner	:	Archene A. Turner
Art Unit	:	1775

Honorable Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

APPEAL BRIEF

Sir:

This brief on Applicant's appeal follows the Notice of Appeal filed November 9, 2007 in the above-identified patent application. (This brief is being filed prior to January 9, 2008, and is therefore timely filed.)

Respectfully submitted,

January 3, 2008

/James Judge/

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(i) Real Party in Interest

The real party in interest is Sumitomo Electric Industries, Ltd., the assignee of record and the mailing address of which is: 5-33 Kitahama 4-chome, Chuo-ku, Osaka-shi, Osaka Pref. 541-0041, Japan.

(ii) Related Appeals and Interferences

No related appeal or interference proceedings have been undertaken in the present application.

(iii) Status of Claims

Briefly, claims 1-24 have been presented during the course of prosecution in the present application.

As of the latest Office action on the merits, dated August 9, 2007 and made final, claims 4-6, 8, 10, 12-14, 16, 19 and 20 were pending and stood rejected by the Examiner for various reasons, there being no claims allowed *per se* or indicated as being conditionally allowable.

More specifically, claims 1-16 were originally presented on filing the present application. Claims 17-20 were added in an amendment dated November 1, 2004; claims 21-23 were added in an amendment dated June 23, 2006; and claim 24 was added in an amendment dated December 7, 2006.

Claims 3 and 7 were canceled in an amendment dated March 30, 2005. Claims 1, 9, 11, and 15 were canceled in an amendment accompanying a first request for continued examination, dated December 5, 2005. Claims 18, 21 and 22 were canceled in the December 7, 2006 amendment, which accompanied a second request for continued examination. Claims 2, 17, 21, 22 and 24 were canceled in an amendment dated May 22, 2007.

In an amendment filed together with the filing of the present appeal brief, and pursuant to the requirements of 37 C.F.R. § 41.33(b)(1), claims 6, 10, and 14 are canceled. (It is respectfully submitted that such cancellation does not affect the scope of any other pending claim in the present appeal proceeding.)

Accordingly, claims 4, 5, 8, 12, 13, 16, 19 and 20 remaining pending. Among these, claims 4, 5, 8, 19, and 20 have been amended at least once during the course of prosecution. Pending claims 12, 13, and 16 remain in their original form as filed.

- The present appeal is from the rejection of claims **4, 5, 8, 12, 13, 16, 19 and 20**, the remaining pending claims.

(iv) Status of Amendments

As noted in the previous section, "Status of Claims," an amendment is being filed on even date with this brief. In this amendment, claims 6, 10, and 14 are canceled, while in conformance with 37 C.F.R. § 41.33, no claims are added nor are any claims amended. The purpose of the amendment is to address the § 112 rejection of claims 6, 10, and 14, made in the August 9, 2007, final Office action on the merits. It should be understood that the § 112 rejection of claims 6, 10 and 14 is not the subject of this appeal.

(v) Summary of Claimed Subject Matter

The present invention relates to surface-coated machining tools. For example, Figs. 1A and 1B of the specification as filed depict a router cutter 1, including a shank 11 having a blade portion 12. (Cf. paragraph [0040] of the specification.) The blade portion 12 is fabricated from a cemented-carbide base material (paragraph [0023]), and further includes a thin film 13 coated thereon. As such a coating, both compound thin films (Examples 1-12 in Table I of the as-filed specification) and a hard carbon thin film (Example 13 in Table I) are disclosed.

Another exemplary embodiment of the present invention involves miniature drills for printed circuit-board processing (paragraph [0048]). Such drills include a machining tool shank having a blade portion (not illustrated). The blade portion is fabricated from a cemented carbide base material (paragraph [0023]) having a thin film coated thereon (paragraph [0049]). As the coating in this embodiment as well, both compound thin films (Examples 14-25 in Table II) and a hard carbon thin film (Example 26 in Table II) are disclosed.

(a) Independent Claim 4 and Its Dependent Claim

The subject matter of independent claim 4 is a machining tool surface-coated with a compound thin film. The tool consists of a shank having a blade portion fabricated as described above from a cemented carbide base material and coated, to a given thickness in a single layer, with a compound thin film made up of a combination of one or more of the elements selected from the group consisting of titanium, chromium, vanadium, silicon, and aluminum, and one or more elements selected from carbon or nitrogen (paragraph [0027]; cf. also Examples 1-12 and 14-25 in Tables I and II).

As further recited in claim 4, the cemented carbide base material contains tungsten carbide and cobalt, with the cobalt inclusion amount being in the range from 4 to 12 weight % (paragraph [0023]). The compound thin film is vapor-deposited onto the base material under conditions, as given in paragraph [0049], for example, that are predetermined to impart a compressive residual stress in the range of from 0.1 to 8 GPa (paragraph [0034]). The compound thin film has a surface roughness in the range of from 0.01 μm to less than 0.3 μm *Ra* (supported by paragraph [0032]; cf. also Examples 1-7 and 9-12 in Table I, and Examples 14-20 and 22-25 in Table II). The compound thin film, as a still further limitation, has a predetermined thickness in the range of from 0.05 μm to less than 1.5 μm (supported by paragraph [0033]).

The subject matter of dependent claim 12 is the same as that of claim 4, but further recites a cemented-carbide base material having a tungsten carbide grain size in the range of from 0.1 to 1.5 μm (paragraph [0023]).

As described in the original specification, machining tools coated with a compound thin film as recited in claim 4 exhibit significantly improved machining capabilities, and in particular, improved service life (paragraphs [0044-0046] and [0052-0054], as well as Tables I and II, far right column). The inventive tools advantageously are particularly resistant to cracking, chipping, and other forms of breakage.

(b) Independent Claim 5 and its Dependent Claims, and Independent Claims 19 and 20

Independent claims 5, 19 and 20 each recite a machining tool surface-coated with a hard carbon thin film. Claims 5, 19 and 20 are similar in that each recites a machining tool comprising a cemented carbide base material containing tungsten carbide and cobalt, with the cobalt inclusion amount being in the range of from 4 to 12 weight % (paragraph [0023]). Each of these claims also recites a hard carbon thin film made up essentially of carbon atoms only, coated directly onto a cutting surface of the base material (paragraph [0028]). Each of these claims further recites a film thickness in the range of from 0.05 to 0.2 μm, and a residual compressive stress of 0.1 to 1 GPa. (Cf. Examples 13 and 26 in Tables I and II, respectively).

Claims 5 and 20 further recite that the hard carbon thin film consists of a single layer deposited on the base material. Claims 5 and 19 recite that the film is fabricated by a physical vapor deposition process. Claim 20 recites that the film is fabricated by a cathodic arc deposition process (paragraph [0030]).

The subject matter of dependent claim 8 is the same as that of claim 5, but further recites a hard carbon thin film having a surface roughness in the range from 0.01 to 0.5 μm *Ra* (paragraph [0032]).

The subject matter of dependent claim 13 is the same as that of claim 5, but further recites a cemented carbide base material having a tungsten carbide grain size in the range of from 0.1 to 1.5 μm (paragraph [0023]). Claim 16 is identical to claim 13, but depends from claim 8 rather than claim 5.

Machining tools including a hard carbon thin film as recited in independent claims 5, 19 and 20 also exhibit significantly improved machining capabilities, and in particular, improved service life (paragraphs [0044-0046] and [0052-0054]). As indicated in Tables I and II, Examples 13 and 26 are even more

resistant to breakage than the above-described compound-thin-film-embodiment Examples 1-12 and 14-15. Hard carbon films also possess other advantages as described in paragraph [0031] of the original specification.

(vi) Grounds of Rejection to Be Reviewed on Appeal

Ground 1 – That, as asserted by the Examiner in the August 9, 2007 Office action, claim 4 is anticipated under 35 U.S.C. § 102(b) by either of two published Japanese unexamined patent applications, Nos. H07-188901 and 2000-308905,[1] in the name of *Hitachi Tool*, or by a published Japanese unexamined patent application, No. 2001-234328, in the name of *Toshiba TungAlloy*.

Ground 2 – That, as asserted by the Examiner in the August 9, 2007 Office action, claims 5, 8, 19 and 20 are anticipated under 35 U.S.C. § 102(b) by U.S. Pat. No. 5,543,210 to *Kullander et al.*, as well as by U.S. Pat. No. 5,952,102 to *Cutler*.

Ground 3 – That, as asserted by the Examiner in the August 9, 2007 Office action, claim 12 is unpatentable under 35 U.S.C. § 103(a) over either of the *Hitachi Tool* references[2] cited above, or Toshiba Tungalloy (JP 2001-234328) in view of Oskarsson (U.S. Pat. No. 6,228,139).

Ground 4 – That, as asserted by the Examiner in the August 9, 2007 Office action, claims 13 and 16 are unpatentable under 35 U.S.C. § 103(a) over either of the above-cited *Kullander et al.* or *Cutler* references, in view of the above-cited *Oskarsson* reference.

- Grounds 2 and 4 each apply to more than one claim. In the appellate review of Grounds 2 and 4, these collectively rejected claims should not stand or fall together, insofar as they are separately identified and arguments in favor of Appellant's appeal from the rejection of each are made below.

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[1] In the Office action of February 22, 2007, claims 2 and 4 were rejected as being anticipated by either of these two *Hitachi Tool* references, yet in the August 9, 2007 action, in stating the § 102(b) rejection of claim 4, the Examiner did not cite the latter of these two references, i.e., Japanese Unexamined Pat. App. Pub. No. 2000-308905. But because the August 9, 2007 action explicitly maintains the rejections of February 22, 2007, Appellant presumes that the claim 4 rejection from which Appellant is hereby appealing should be considered to have been made over this second *Hitachi Tool* reference also.

[2] Again, in making the § 103(a) rejection of claim 12, the August 9, 2007 action did not cite the latter of the *Hitachi Tool* references, yet maintained the § 103(a) rejection from the February 22, 2007 action. Thus, in this instance as well, Appellant presumes that the claim 12 rejection from which Appellant is hereby appealing should be considered to have been made over the second *Hitachi Tool* reference.

(vii) Argument

Ground 1 – That claim 4 is anticipated under 35 U.S.C. § 102(b) by *Hitachi Tool* (JP H07-188901 or 2000-308905) or *Toshiba TungAlloy* (JP 2001-234328).

Appellant respectfully submits that the Examiner's § 102(b) rejection of independent claim 4 is deficient.

First, Appellants note that the Examiner has not clearly articulated how claim 4 is anticipated by the prior art. The Examiner's comments in full are as follows. "*Hitachi Tool* or *Toshiba TungAlloy* disclose the claimed coating on the claimed substrate." The Examiner has failed to make even the rudiments of a showing of anticipation in the manner that, according to MPEP § 2131, should be the Office's practice.

Appellant further submits that the Examiner has not presented factual evidence that either of the *Hitachi Tool* references, or the *Toshiba TungAlloy* reference, do in fact anticipate claim 4. Appellant respectfully submits that claim 4 is, in fact, patentable over the cited *Hitachi Tool* and *Toshiba TungAlloy* references. These references are addressed individually below.

(a) *Hitachi Tool* '901

In its current form, claim 4 recites:

> A surface-coated machining tool, consisting of:
>
> a machining tool shank having a blade portion . . .; and
>
> coated to a given thickness in a single layer over said cemented-carbide base material, a compound thin film.

It is to be noted that the device of claim 4 consists of (i) a machining tool shank, and (ii) a single-layer compound thin film. In claim 4, Appellant used the preamble-to-body transitional phrase "**consisting of**" to explicitly disclaim multi-layer structures—of which *Hitachi Tool* '901 is one example.

Appellant submits that claim 4 distinguishes over *Hitachi Tool* '901 for at least two reasons. First, the reference teaches a structure with a multi-layer film having **five layers** (cf. paragraph [0009] therein). The *Hitachi Tool* reference is void of any teaching or suggestion of a single-layer film coated over a machining tool shank. Second, paragraph [0009] of *Hitachi Tool* '901 teaches that each of the five layers has a film thickness in the range of from 0.5 to 10 μm, which results in an overall film thickness in the range of from 2.5 to 50 μm.

This range is completely outside the 0.05 to 1.5 μm range recited in claim 4. Appellant therefore submits that *Hitachi Tool* '901 cannot anticipate claim 4. Hence, withdrawal of the rejection is requested.

(b) *Hitachi Tool* '905

As noted above, claim 4 recites:

> A surface-coated machining tool, consisting of:
>
> a machining tool shank having a blade portion . . .; and
>
> coated to a given thickness in a single layer over said cemented-carbide base material, a compound thin film.

Claim 4 also recites, "wherein said predetermined **thickness of said compound thin film is 0.05 μm or more and less than 1.5 μm**." (Emphasis added.) *Hitachi Tool* '895 is void of any teaching or suggestion of a film thickness in the recited range. In contrast to the recited range, the *Hitachi Tool* reference teaches a structure having a film thickness of **2 μm**. Appellants therefore submit that the *Hitachi Tool* '895 cannot anticipate claim 4, and thus request withdrawal of the rejection.

Appellants note that the Examiner may have mistakenly misinterpreted Table 1 of *Hitachi Tool* '895 as disclosing coating thicknesses in the recited range. Table 1 makes no such disclosure, nor even teaching. On the contrary, Table 1 of *Hitachi Tool* '895 presents the results of an oxidation test in which the aforementioned 2 μm coatings were heated to 900°C for 1 hour in air. (Cf. paragraph [0013] of the reference.) The test caused surface oxidation of the 2 μm coatings. Table 1 records the thicknesses of the surface oxide layers that formed during the test. These oxide layers are in no way related to the patentability of claim 4.

(c) *Toshiba TungAlloy* '328

As noted above, claim 4 recites,

> A surface-coated machining tool, consisting of:
>
> a machining tool shank having a blade portion . . .; and
>
> coated to a given thickness in a single layer over said cemented-carbide base material, a compound thin film.

Claim 4 also recites, "wherein said predetermined thickness of said compound thin film is 0.05 μm or more and less than 1.5 μm."

Appellants respectfully submit that the *Toshiba TungAlloy* reference teaches a multi-layer coating structure, and that *Toshiba TungAlloy* makes no teaching or suggestion of a single-layer coating as recited in claim 4. On the contrary, paragraph [0017] of *Toshiba TungAlloy* teaches a coating structure including a minimum of two layers. *Toshiba TungAlloy* also teaches that a compound hard film is an essential component of the multi-layer coating. In the exemplary embodiments described, the coating disclosed by *Toshiba TungAlloy* includes various other under-layers and over-layers in addition to the compound hard film.

Paragraph [0019] of the Toshiba Tungalloy reference also describes embodiments in which the multi-layer coating includes no under-layers or over-layers, but rather a multi-layer compound hard film deployed directly onto a base material. The Toshiba Tungalloy reference is void of any teaching or suggestion of a coating structure including only a single layer compound hard film.

As pointed out earlier, Appellant has used the transition "**consisting of**" to explicitly disclaim multi-layer coating structures, of which *Toshiba TungAlloy* is one prior-art teaching. As just touched upon, *Toshiba TungAlloy* in contrast *disallows*, for all intents and purposes, its coating from being constituted by a single-layer compound film alone. Appellant's undersigned representative has singled out the above-referenced paragraphs [0017] and [0019] of *Toshiba TungAlloy* as most material to the nature of the coating structures *Toshiba TungAlloy* actually discloses and teaches. For the Board's reference in its review of the ground of rejection based on *Toshiba TungAlloy*, paragraphs [0017] and [0019] from the Japanese original are cited below and followed by a translation made by Appellant's undersigned representative and that Appellant's undersigned representative hereby attests to being as faithful as possible.

- *Toshiba TungAlloy* paragraph [0017]:

  【００１７】これらの基材表面に被覆される複合硬質膜を含む被覆層の構成は、基材に隣接して密着性を目的に被覆される下地層、この下地層に隣接して被覆される本発明における複合硬質膜でなる中間層、この中間層に隣接して被覆される外層、この外層の表面に使用前後の判別および装飾目的で被覆される最外層などを２層以上に積層する構成、

[0017] The construction of the composite-hard-film-including coating layers coated onto the surface of these base materials[3] is a construction in which are laminated, **into two layers or more**, layers such as:[4] an underlayer, coated adjoining the base material with the objective of adherence; an intermediate layer, being a composite hard film of the present invention, coated adjoining the underlayer; an outer layer, coated adjoining the intermediate layer; and an outermost layer, coated onto the surface of the outer layer, with the objectives of ornamentation and of discriminating pre-/ post-use;

具体的には、例えば基材の表面に順次被覆される被覆層が **i)**[5] 基材一下地層一複合硬質膜（中間層）一外層一最外層からなる積層の構成、**ii)** 基材一下地層一複合硬質膜（中間層）一外層からなる積層の構成、**iii)** 基材一下地層一複合硬質膜（中間層）の積層からなる構成、**iv)** 基材一下地層一複合硬質膜（中間層）一最外層からなる積層の構成、**v)** 基材一複合硬質膜（中間層）一外層一最外層からなる積層の構成、**vi)** 基材一複合硬質膜（中間層）一外層からなる積層の構成、**vii)** 基材一複合硬質膜（中間層）一最外層の積層からなる構成、または **viii)** 基材一複合硬質膜（中間層）の構成、を挙げることができる。

the coating layers coated sequentially onto the surface of the base material may be, to give specific examples: **i)** a laminated construction comprising base material—underlayer—composite hard film (intermediate layer)—outer layer—outermost layer; **ii)** a laminated construction comprising base material—underlayer—composite hard film (intermediate layer)—outer layer; **iii)** a construction comprising a laminate of [6] base material—underlayer—composite hard film (intermediate layer); **iv)** a laminated construction comprising base material—underlayer—composite hard film (intermediate layer)—outermost layer; **v)** a laminated construction comprising base material—composite hard film (intermediate layer)—outer layer—outermost layer; **vi)** a laminated construction comprising base material—composite hard film (intermediate layer)—outer layer; **vii)** a construction comprising

[3] The base materials are detailed in paragraph [0012]; basically, they preferably are "materials conventionally employed in cutting tools and in wear-resistant tools."
[4] More literally, "a construction in which are laminated, into two layers or more, an underlayer. . ., an intermediate layer. . ., an outer layer. . ., an outermost layer, **etc.**"
[5] The "i) . . . viii)" enumeration, added for clarity, does not appear in the original.
[6] Note the slightly different phrasing here—it appears to be deliberate, because it is repeated later.

a laminate of[7] base material—composite hard film (intermediate layer)—outermost layer; or **viii)** a base-material—composite-hard-film (intermediate-layer) construction[8].

- *Toshiba TungAlloy* paragraph [0019]:

【００１９】本発明の骨子となる複合硬質膜は、硬被覆層自体が複合質膜でなる場合、別の表現をすると、基材表面に複合硬質膜のみが被覆された構成でなる場合、基材表面に上述の下地層と複合硬質膜とが被覆されている構成の場合、または前述の被覆層の構成のように中間層として被覆されている構成の場合がある。

[0019] As to the composite hard films that are the gist of the present invention, there are instances in which the coating layers themselves are formed by the composite hard films—or to put it differently, instances formed by a construction in which only the composite hard films are coated onto the base-material surface—instances of a construction in which the above-described underlayer and composite hard films are coated onto the base-material surface, as well as instances of a construction in which, as in the earlier-described construction of the coating layers, [the composite hard films][9] are coated on as the intermediate layer.

この複合硬質膜の組成成分、膜質は、具体的な例示として化学式により記載すると、（Ｔｉ，ＡｌＮ、（Ｔｉ，ＡｌＣ、（Ｔｉ，Ａｌ）（Ｃ，Ｎ）、（Ｔｉ，Ａｌ）（Ｎ，Ｏ）、（Ｔｉ，Ａｌ）（Ｃ，Ｏ）、（Ｔｉ，Ａｌ）（Ｃ，Ｎ，Ｏ）、（Ｔｉ，Ａｌ，Ｍ）Ｎ、（Ｔｉ，Ａｌ，Ｍ）Ｃ、（Ｔｉ，Ａｌ，Ｍ）（Ｃ，Ｎ）、（Ｔｉ，Ａｌ，Ｍ）（Ｎ，Ｏ）、（Ｔｉ，Ａｌ，Ｍ）（Ｃ，Ｏ）、および（Ｔｉ，Ａｌ，Ｍ）（Ｃ，Ｎ，Ｏ）の中から選ばれた少なくとも１種の単層または積層でなる場合を挙げることができる。

To state the compositional components and properties of the composite hard films by chemical formula as specific illustrations, instances in which [the composite hard films] are formed by a single layer or laminate of at least one selected from among (Ti/Ai)N, (Ti/Al)C, (Ti/Al)(C/N), (Ti/Al)(N/O), (Ti/Al)(C/O), (Ti/Al)(C/N/O), (Ti/Al/M)N, (Ti/Al/M)C, (Ti/Al/M)(C/N), (Ti/Al/M)(N/O), (Ti/Al/M)(C/O), and (Ti/Al/M)(C/N/O) may be given as examples.

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[7] See previous note.
[8] See note 4.
[9] This subject is not explicitly stated at this place in, but is quite clear from, the original.

Although not easily followed, the above description from *Toshiba Tungalloy* indicates that while the reference does teach, as in paragraph [0019], that the composite hard films may be formed by a single layer or laminate, the composite hard films must be just that—films in the plural, not a lone film—because even in the paragraph-[0019]-listed implementation in which the composite hard films are coated as an intermediate layer directly onto a base material, they are stipulated as being in a coating-layer construction as described earlier, that is, as described in paragraph [0017]. And even the eighth-listed coating-layer construction in paragraph [0017], that is, the base-material—composite-hard-film (intermediate-layer) construction, must be a construction in which the coating layers are laminated **into two layers or more**—hence, a construction in which at least two composite hard films constitute the coating layers.

Appellant therefore submits that the *Toshiba Tungalloy* reference cannot anticipate claim 4, and request withdrawal of the rejection.

Appellant respectfully further submits that the *Toshiba Tungalloy* reference does not disclose a compound thin film thickness in the range from 0.05 to 1.5 μm. Claim 7 of the *Toshiba Tungalloy* reference recites a film thickness in the range from 1 to 15 μm, while paragraph [0027] recites a film thickness in the range from 1 to 20 μm. Although these ranges appear to overlap the film thickness range recited in claim 4, they are merely generic ranges.

To begin with, reasoning from paragraphs [0017] and [0019] as parsed above, there is no support or enablement in the *Toshiba Tungalloy* description for compound films having a thickness of less than 3 μm. Furthermore, the data for Embodiments 1-6 (presented in Table 2 at the bottom of page 8 of *Toshiba Tungalloy*) teach thicknesses in the range of from 5 to 7 μm (paragraph [0037]); the data for Embodiments 7-13 (presented in Table 4 at the bottom of page 9) teach thicknesses in the range of from 3 to 6 μm (paragraph [0040]); the data for Embodiments 14-17 (presented in Table 5 at the bottom of page 10) teach film thicknesses of 5 μm (paragraph [0045]); and the data for Embodiments 18-21 (presented in Table 6 on page 11) also teach film thicknesses of 5 μm (paragraph [0048]).

Appellant therefore respectfully submits that the Toshiba Tungalloy reference does not disclose or enable a compound film thickness in the range of from 0.05 to 1.5 μm as recited in claim 4. In fact, as argued above, there is no adequate disclosure or enablement of a film thickness less than 3 μm. Moreover, when considered in proper context, *Toshiba Tungalloy* teaches a thick, multi-layer coating structure, in contrast to the thin, single-layer structure recited in claim 4. Appellant therefore submits that the *Toshiba Tungalloy* reference cannot anticipate claim 4 for the second substantive reason just argued, and for that reason as well also requests withdrawal of the rejection.

Claim 4 further limits the film to having a "compressive residual stress of 0.1 GPa or more and 8 GPa or less." Appellant respectfully submits that the *Toshiba Tungalloy* reference is void of any such teaching, disclosure, or suggestion. Moreover, since the *Toshiba Tungalloy* reference teaches compound films having a thickness at least twice that of the instant invention (3 μm versus the claim 4 upper limit of 1.5 μm), it is highly unlikely that the recited compressive stress range is inherent in the *Toshiba Tungalloy* reference. Appellant therefore submits for a third substantive reason that the *Toshiba Tungalloy* reference cannot anticipate claim 4, and for that reason as well also requests withdrawal of the rejection.

In conclusion, Appellant respectfully submits that each of the Examiner's § 102(b) rejections is improper for the reasons set forth above, and therefore respectfully reiterates Appellant's request that the rejections be withdrawn and that claim 4 be allowed.

Ground 2 – Whether claims 5, 8, 19 and 20 are anticipated under 35 U.S.C. § 102(b) by *Kullander et al*. (U.S. Pat. No. 5,543,210) or *Cutler* (U.S. Pat. No. 5,952,102).

Appellant respectfully submits that the Examiner's § 102(b) rejection of independent claims 5, 19, and 20 is deficient.

Again, Appellant notes that the Examiner has not clearly articulated how the rejected claims are anticipated by the prior art. The Examiner's comments in full are as follows: "*Kullander et al*. or *Cutler* disclose the claimed carbon coating directly on a WC substrate within the claimed thickness, stress and roughness." The Examiner has failed to make even the rudiments of a showing of anticipation in the manner that, according to MPEP § 2131, should be the Office's practice.

Appellants further submit that the Examiner has not presented factual evidence that either *Kullander et al*. or *Cutler* do in fact anticipate claims 5, 19, and 20. Appellants respectfully submit that claims 5, 19, and 20 are, in fact, patentable over the cited *Kullander et al*. and *Cutler* references. In the following arguments, these references are addressed individually.

(a) *Kullander et al*. '210

Each of independent claims 5, 19, and 20 recites:

> A surface-coated machining tool, comprising:
> a cemented-carbide base material containing tungsten carbide and cobalt . . .; [and]
> a hard carbon thin film made up essentially of carbon atoms only, coated to a thickness in the range of 0.05 to 0.2 μm over the cutting surface of said cemented-carbide base material.

Claims 5, 19, and 20 each also recite that the hard carbon film has "a compressive residual stress of 0.1 GPa or more and 1 GPa or less."

Kullander et al. neither teaches nor suggests the film-thickness or the compressive-stress limitation. Regarding the film thickness limitation, *Kullander et al*. broadly teaches a range of film thicknesses from 1 to 20 μm (column 3, line 9). The low end of this range is a full ***five times greater*** than the upper end of the film thickness range recited in claims 5, 19, and 20. Moreover, the examples in the *Kullander et al*. reference provide no suitable enablement for the lower end of the range. Examples 1, 2, 4, 5 and 7 therein teach films having a thickness of 10 μm, while Examples 3 and 6 teach films having a thickness of 5 μm. Clearly, there is no suggestion or disclosure in *Kullander et al*. of a hard carbon film having a thickness in the range of from 0.05 to 0.2 μm, as recited in claims 5, 19 and 20 of the present application. The Examiner's § 102(b) rejection is therefore improper.

Regarding the compressive residual stress limitation, *Kullander et al*. teaches a structure in which a diamond layer is over coated with a CrN layer (layer A in the scanning electron micrograph). The purpose of this CrN layer is to improve the flaking resistance and wear resistance of the diamond layer (column 2, lines 40-56). In other words, the CrN layer is deposited over the diamond layer in order to retard delamination of the diamond layer from the cemented carbide tool body. If the compressive stress of the diamond layer disclosed by *Kullander et al*. was in the range—0.1 to 1 GPa—recited in claims 5, 19 and 20 of the present application, then the disclosed diamond layer would likely not delaminate, and the CrN overlayer (which is the essence of the *Kullander et al*. invention) would not be necessary.

Furthermore, as described above, the examples presented by *Kullander et al*. have a diamond layer thickness in the range of from 5 to 10 μm. It is well-known to those of ordinary skill in the art that diamond films of such thickness have compressive stresses greater than the range recited in Appellant's claims 5, 19 and 20. For example, paragraph [0033] of Appellant's original specification states: "at film thicknesses . . . in excess of 3 μm there were

problems in that **internal stress accumulating in the coating would grow large**, making it prone to peeling off and producing chips in the coating." (Emphasis added.) Hence, it is clear that the diamond layer disclosed by *Kullander et al*. has a compressive stress of greater than 1 GPa. Again, this is the reason for the CrN layer taught by *Kullander et al*. Appellant, therefore, submits that the Examiner's § 102(b) rejection of claims 5, 19 and 20 is improper for a second substantive reason, at least on that basis request withdrawal of the rejection.

Regarding claim 8, (which depends from claim 5), *Kullander et al*. makes no mention of the surface roughness of the carbon film. *Kullander et al*. does teach (column 3, lines 17-18) a chromium containing overlayer (the CrN layer discussed in the preceding paragraph) having a surface roughness in the recited range. Notwithstanding this teaching, there is no disclosure regarding the surface roughness of the hard carbon film. Accordingly, *Kullander et al*. cannot anticipate claim 8. Appellant therefore submits that claim 8 is further patentable over *Kullander et al*.

(b) *Cutler* '102

As noted above, each of independent claims 5, 19 and 20 recites:

> A surface-coated machining tool, comprising:
> a cemented-carbide base material containing tungsten carbide and cobalt . . .; [and]
> a hard carbon thin film made up essentially of carbon atoms only, coated to a thickness in the range of 0.05 to 0.2 μm over the cutting surface of said cemented-carbide base material.

Cutler neither teaches nor suggests a hard carbon film having a thickness in the range from 0.05 to 0.2 μm, as recited in Appellant's independent claims 5, 19 and 20. On the contrary, *Cutler* teaches diamond films having thicknesses of **many microns**. For example, at column 3, line 2 and at column 6, line 58, *Cutler* teaches that a **thin** diamond coating has a thickness of less than **30 μm**. At column 6, lines 64-67, *Cutler* teaches that thicker films have a thickness of **greater than 30 μm**, and that diamond coatings having a thickness **in excess of 100 μm** may be utilized. Column 6, lines 40-44 teaches that while thin films (< 30 μm) may be used, thicker films are preferred (preferably between 50 and 100 μm). Thus, the general teaching of *Cutler* is a system having diamond films many orders of magnitude thicker than those of the instant invention. Appellant also notes that *Cutler*'s exemplary embodiments (Examples 9-11) also teach very thick films—30 and 60 μm—as compared with the instant invention. Appellant respectfully submits that there is no way that a diamond film thickness of < 30 μm (but

preferably between 50 and 100 μm) can be said to anticipate or even suggest a hard carbon film thickness in the range from 0.05 to 0.2 μm, inasmuch as a 30 μm film is 150 times thicker than a 0.2 μm film.

At column 8, lines 40-45, and in claim 11, *Cutler* appears to teach a thinner diamond film. In particular, *Cutler* seems to teach a three layer structure comprising: (i) a substrate; (ii) a ceramic layer disposed over the substrate; and (iii) a diamond coating over the ceramic layer, in such a way that the ceramic layer is interposed between the substrate and the diamond layer. (Cf. also claim 9 of *Cutler*.) It appears that the purpose of the ceramic layer is to promote adhesion of the diamond layer (column 8, line 25). Even in such embodiments, *Cutler* explicitly teaches a film thickness of greater than 1 μm (which as stated above is a full **five times greater** than the upper end of the film thickness range recited in claims 5, 19, and 20). Thus, there is no way that *Cutler* can be said to teach or even suggest a structure having a hard carbon film with a thickness in the range from 0.05 to 0.2 μm, as is recited in Appellant's independent claims 5, 19 and 20. Appellant, therefore, submits that the Examiner's § 102(b) rejection of claims 5, 19 and 20 is improper and requests withdrawal of the rejection.

Regarding claim 8, which depends from claim 5, *Cutler* makes no mention of the surface roughness of the film. Thus there is no way that *Cutler* can be said to anticipate or suggest the limitation of the "hard carbon thin film [being] surface roughness adjusted to be 0.01 μm or more and 0.5 μm or less by indication Ra" as recited in claim 8. Appellant therefore submits that claim 8 is further patentable over the *Cutler* reference.

In conclusion, Appellant respectfully submits that each of the Examiner's § 102(b) rejections is improper for the reasons set forth above. Appellant therefore respectfully reiterates Appellant's request that the rejections be withdrawn and that claims 5, 8, 19 and 20 be allowed.

Ground 3 – Whether claim 12 is unpatentable under 35 U.S.C. § 103(a) over *Hitachi Tool* (JP 07-188901 or 2000-308905) or *Toshiba TungAlloy* (JP 2001-234328), in view of *Oskarsson* (U.S. Pat. No. 6,228,139).

Appellant respectively submits that Ground 3 is moot in view of the comments set forth above with respect to Ground 1. Appellant has argued that independent claim 4 is allowable over the prior art of record. Claim 4 being allowable, it follows that dependent claim 12 must also be allowable.

<u>Ground 4</u> – Whether claims 13 and 16 are unpatentable under 35 U.S.C. § 103(a) over *Kullander et al.* (U.S. Pat. No. 5,543,210) or *Cutler* (U.S. Pat. No. 5,952,102), in view of *Oskarsson* (U.S. Pat. No. 6,228,139).

Appellant respectively submits that Ground 4 is moot in view of the comments set forth above with respect to Ground 2. Appellant has argued that independent claim 5 is allowable over the prior art of record. Claim 5 being allowable, it follows that dependent claims 13 and 16 must also be allowable.

(viii) Claims Appendix

Claims 1-3 (canceled)

Claim 4 (previously presented): A surface-coated machining tool, consisting of:

a machining tool shank having a blade portion, the blade portion fabricated from a cemented-carbide base material containing tungsten carbide and cobalt, with the cobalt inclusion amount being 4 weight % or more and 12 weight % or less; and

coated to a given thickness in a single layer over said cemented-carbide base material, a compound thin film made up of a combination of, in given elemental proportions, one or more elements selected from the group titanium, chromium, vanadium, silicon and aluminum, and one or more elements selected from carbon and nitrogen; wherein

said compound thin film is vapor-deposited onto said base material under reaction-gas pressure, base-material bias voltage, and deposition-temperature conditions that, together with said given thickness and said given elemental proportions, are predetermined so as to impart a compressive residual stress of 0.1 GPa or more and 8 GPa or less to said compound thin film,

said compound thin film has a surface roughness of 0.01 μm or more and less than 0.3 μm by indication Ra, and

said predetermined thickness of said compound thin film is 0.05 μm or more and less than 1.5 μm.

Claim 5 (previously presented): A surface-coated machining tool, comprising:

a cemented-carbide base material containing tungsten carbide and cobalt, the cemented-carbide base material having a bulk cobalt concentration of 4 weight % or more and 12 weight % or less, the cemented-carbide base material including a cutting surface;

a hard carbon thin film made up essentially of carbon atoms only, coated to a thickness in the range of 0.05 to 0.2 μm over the cutting surface of said cemented-carbide base material by a physical vapor deposition method in which graphite is made a raw material, and under reaction-gas pressure, base-material bias voltage, and deposition-temperature conditions that, together with said given thickness, are predetermined so as to impart a compressive residual stress of 0.1 GPa or more and 1 GPa or less to said compound thin film; wherein

the hard carbon thin film consists of a single layer deposited on the cemented-carbide base material such that substantially the entire hard carbon thin film is in direct contact with the cemented-carbide base material.

Claims 6-7 (canceled)

Claim 8 (previously presented): The surface-coated machining tool set forth in claim 5, wherein said hard carbon thin film is surface roughness adjusted to be 0.01 μm or more and 0.5 μm or less by indication Ra.

Claim 9-11 (canceled)

Claim 12 (original): The surface-coated machining tool set forth in claim 4, wherein the tungsten carbide in said cemented-carbide base material is 0.1 μm or more and 1.5 μm or less in pre-sintering crystal-grain size.

Claim 13 (original): The surface-coated machining tool set forth in claim 5, wherein the tungsten carbide in said cemented-carbide base material is 0.1 μm or more and 1.5 μm or less in pre-sintering crystal-grain size.

Claim 14-15 (canceled)

Claim 16 (original): The surface-coated machining tool set forth in claim 8, wherein the tungsten carbide in said cemented-carbide base material is 0.1 μm or more and 1.5 μm or less in pre-sintering crystal-grain size.

Claim 17-18 (canceled)

Claim 19 (previously presented): A surface-coated machining tool, comprising:

a cemented-carbide base material containing tungsten carbide and cobalt, with the cobalt inclusion amount being 4 weight % or more and 12 weight % or less; and

a hard carbon thin film made up essentially of carbon atoms only, coated to a thickness in the range of 0.05 to 0.2 μm directly onto a surface of said cemented-carbide base material in a single layer, by a physical vapor deposition method in which graphite is made a raw material, and under reaction-gas pressure, base-material bias voltage, and deposition-temperature conditions that, together with said thickness, are predetermined so as to impart a compressive residual stress of 0.1 GPa or more and 1 GPa or less to said compound thin film.

Claim 20 (previously presented): A surface-coated machining tool, comprising:

a cemented-carbide base material containing tungsten carbide and cobalt, the cemented-carbide base material having a bulk cobalt concentration of 4 weight % or more and 12 weight % or less, the cemented-carbide base material including a cutting surface;

a hard carbon thin film made up essentially of carbon atoms only, coated to a thickness in the range of 0.05 to 0.2 μm over the cutting surface of said cemented-carbide base material, by a cathodic-arc deposition method in which graphite is made a raw material, and under reaction-gas pressure, base-material bias voltage, and deposition-temperature conditions that, together with said given thickness, are predetermined so as to impart a compressive residual stress of 0.1 GPa or more and 1 GPa or less is imparted to said hard carbon thin film; wherein

the hard carbon thin film consists of a single layer deposited on the cemented-carbide base material such that substantially the entire hard carbon thin film is in direct contact with the cemented-carbide base material.

Claims 21-24 (canceled)

(ix) Evidence Appendix

- None -

(x) Related Proceedings Appendix

- None -